PPS[1], MPE[2] Update

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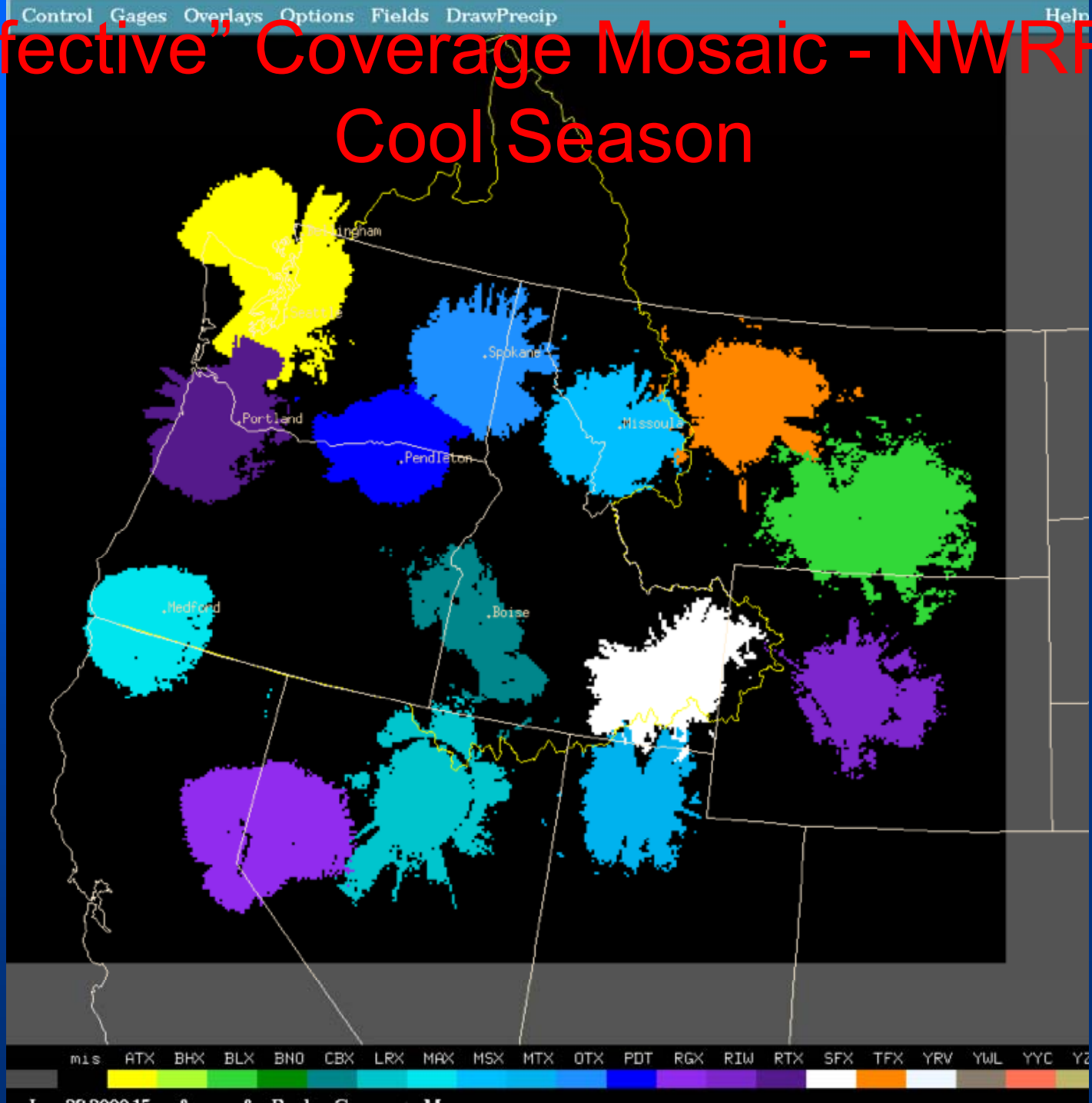
May 22, 2002

1 (WSR-88D) Precipitation Processing Subsystem
2 (AWIPS) Multi-Sensor Precipitation Estimator

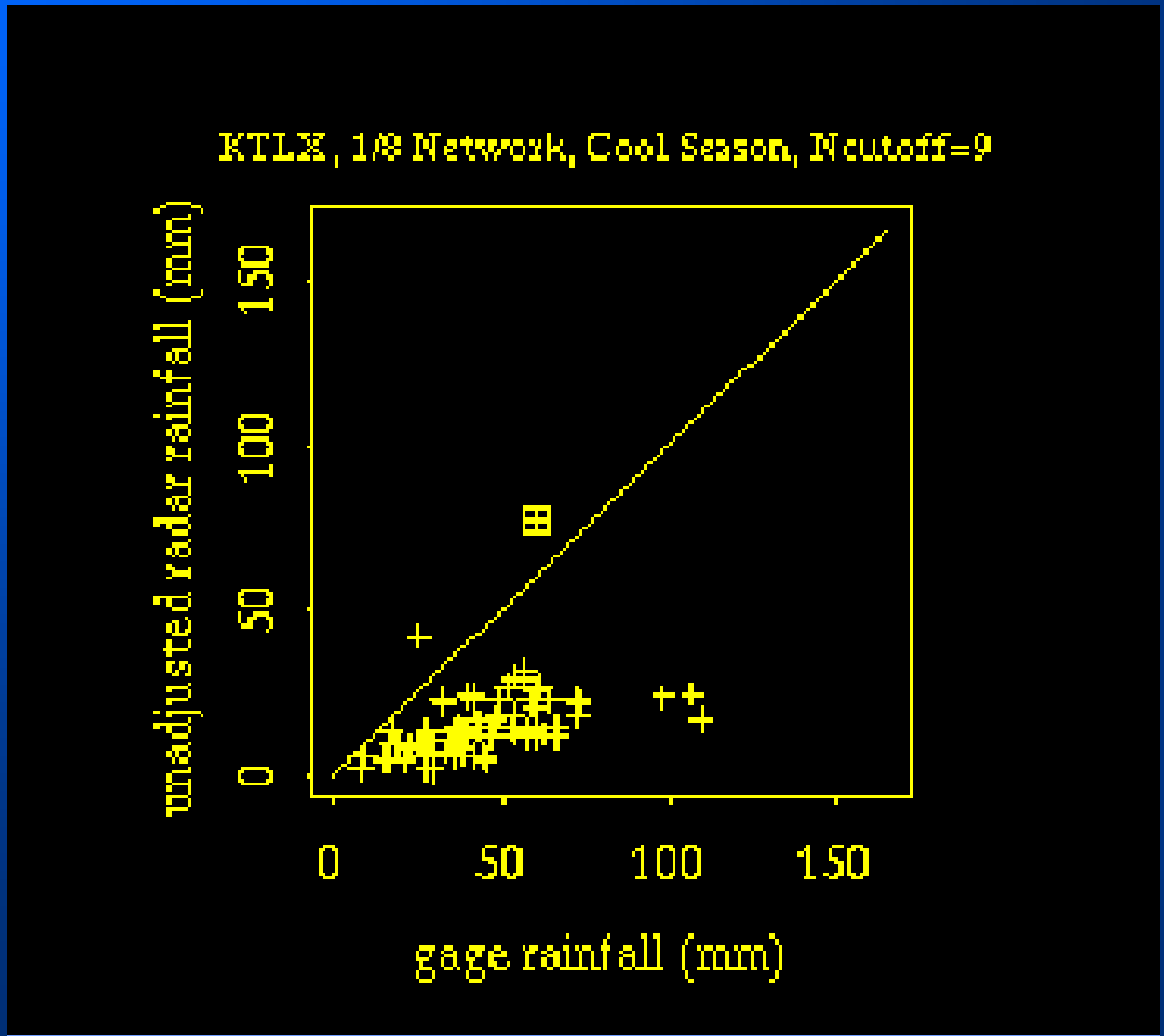
Issues driving improvements in radar-based/aided precipitation estimation

- Systematic biases in
  - detection of precipitation
  - estimation of (in particular, large) precipitation amount given successful detection of precipitation

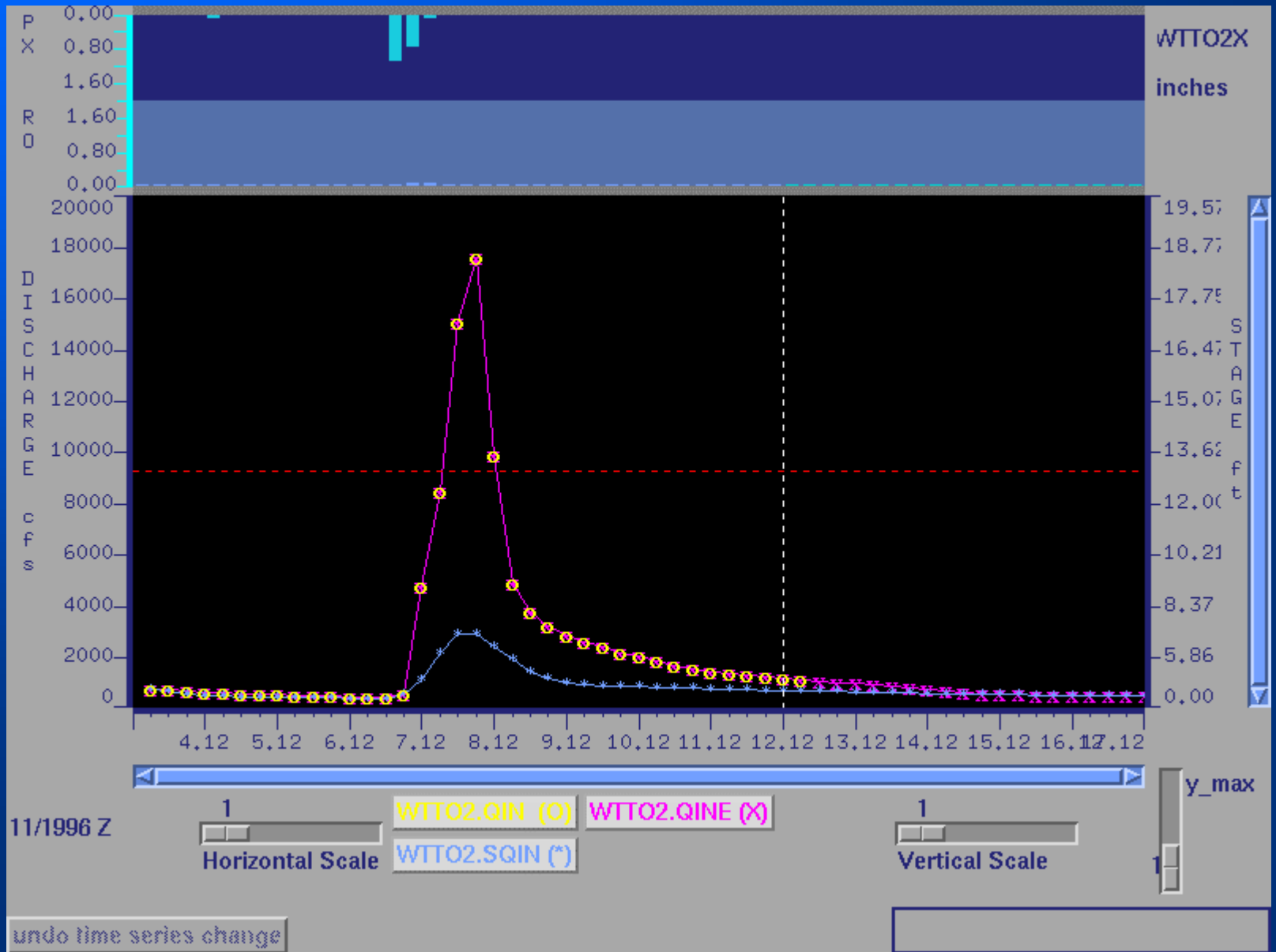
"Effective" Coverage Mosaic - NWRFC, Cool Season



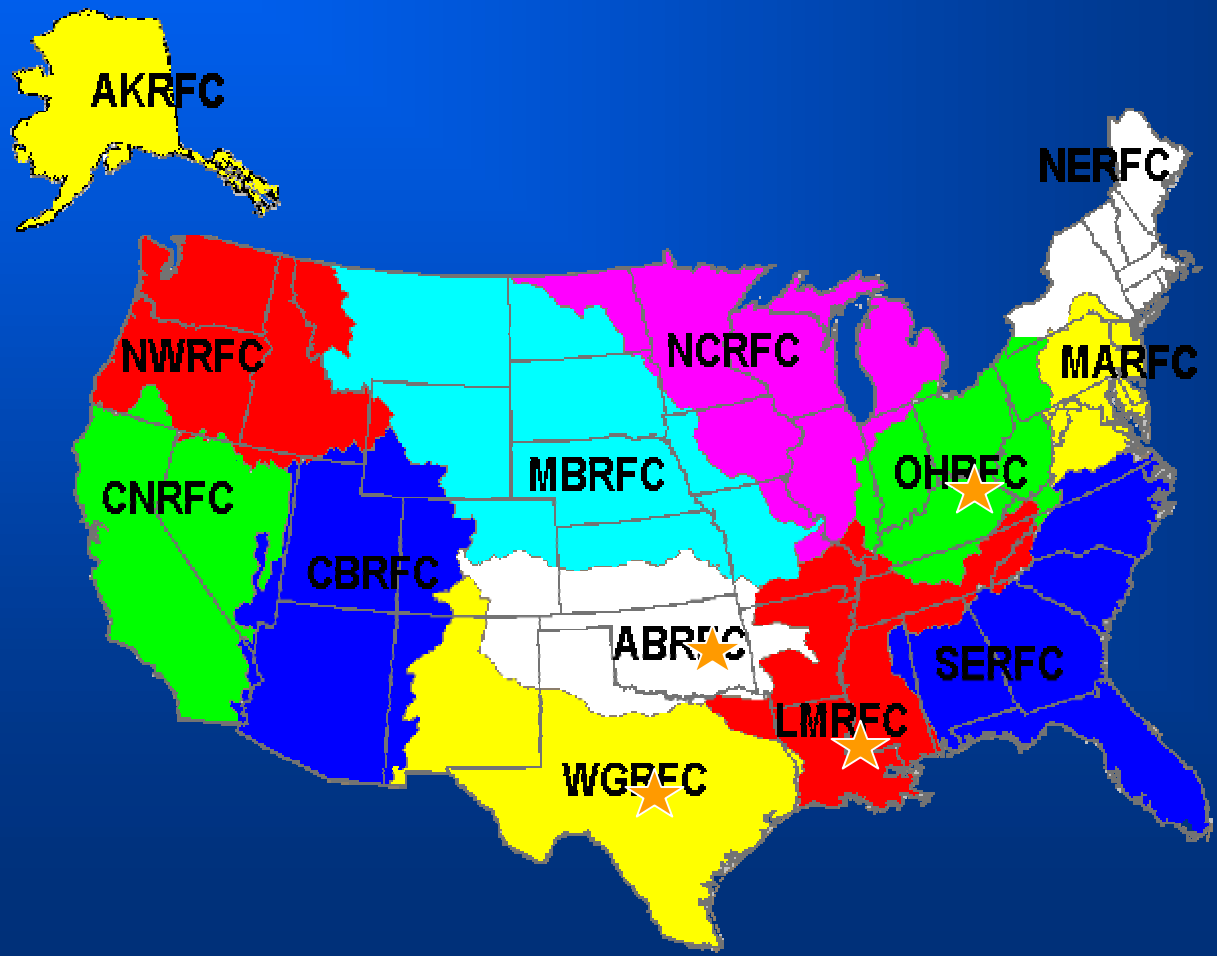
Mean field bias due, e.g., to lack of radar calibration



Hydrograph Simulation - Biased Precipitation Input



Use of Radar-Based/Aided Precipitation Estimates In Quantitative Hydrologic Forecasting



PPS - ORPG Bld 1

- (Quick) Fix to the truncation problem [OHD]

PPS - ORPG Bld 2

- Mean Field Bias correction (MFB) [OHD]
- Radar Echo Classifier (REC) [NCAR,ROC,OST]

Product Tabular Data

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SUPPLEMENTAL PRECIPITATION DATA - RDA ID   303  05/08/02 21:03

VOLUME COVERAGE PATTERN = 21    MODE = A     TIME CONT: PASSED

      GAGE BIAS APPLIED                  -      YES
           BIAS ESTIMATE                 -     0.90
           EFFECTIVE # G/R PAIRS         -    11.47
           MEMORY SPAN (HOURS)           -   168.01
           DATE/TIME LAST BIAS UPDATE    - 05/08/02 21:05

      NUMBER OF ISOLATED BINS            -      413
                INTERPOLATED OUTLIERS    -        0
                REPLACED OUTLIERS        -        0
       AREA REDUCTION (PERCENT)          -    39.88
       BI-SCAN RATIO   (RATIO)           -     0.00
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Product Tabular Data

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GAGE-RADAR MEAN FIELD BIAS TABLE

LAST BIAS UPDATE TIME: 05/08/02 21:05 BIAS APPLIED ? YES

MEMORY SPAN (HOURS)	EFFECTIVE NO. G-R PAIRS	AVG. GAGE VALUE (MM)	AVG. RADAR VALUE (MM)	MEAN FIELD BIAS
0.001	0.000	2.794	1.189	2.351
1.000	0.000	2.794	1.189	2.351
2.000	0.000	2.794	1.189	2.351
3.001	0.000	2.790	1.189	2.347
4.998	0.000	2.758	1.196	2.307
10.004	0.012	2.672	1.252	2.134
168.006	11.471	2.230	2.477	0.900
719.819	107.348	2.436	2.992	0.814
2160.295	248.829	2.551	2.980	0.856

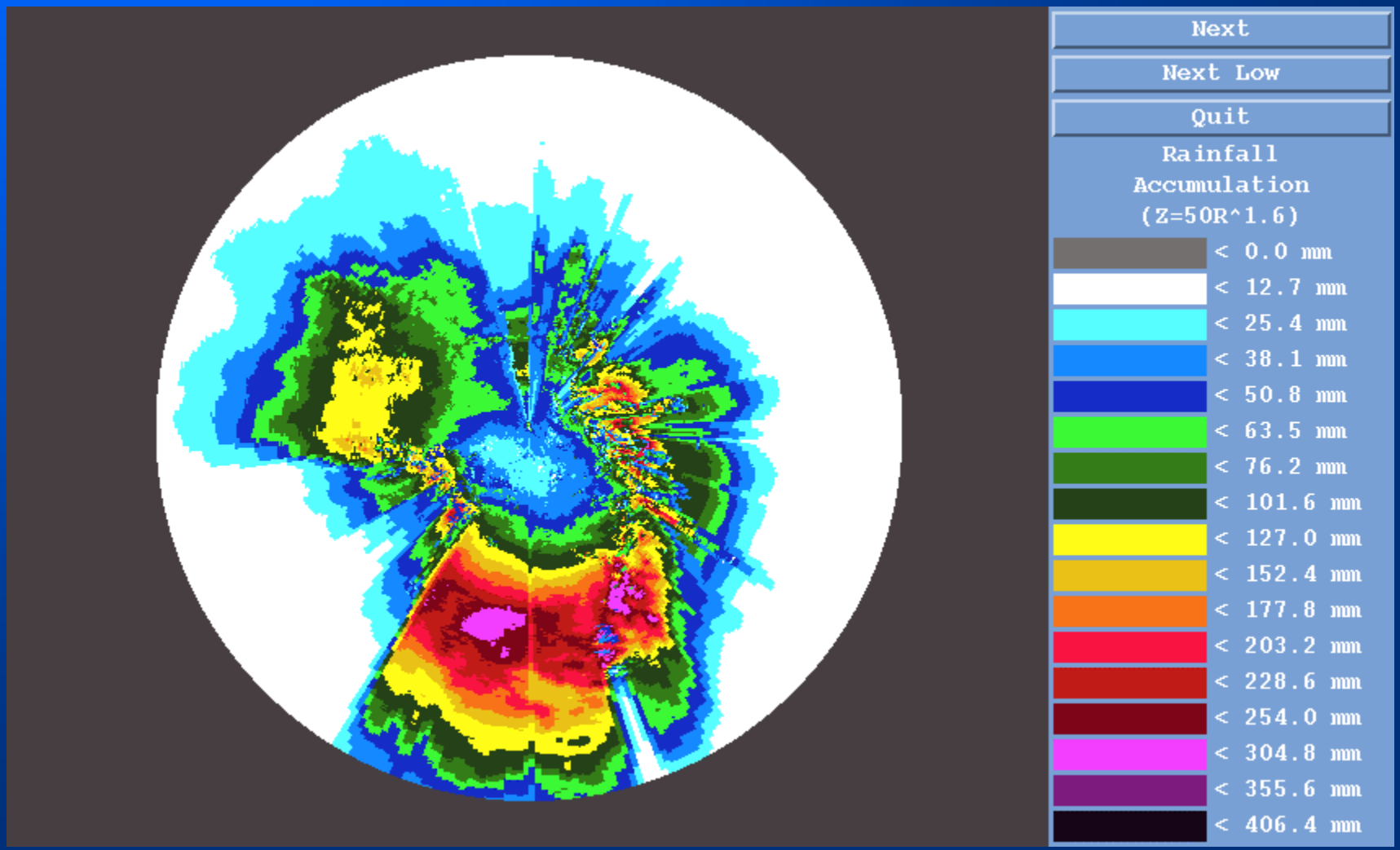
PPS - ORPG Bld 3

- Digital Storm Total product (DSP) [OHD]

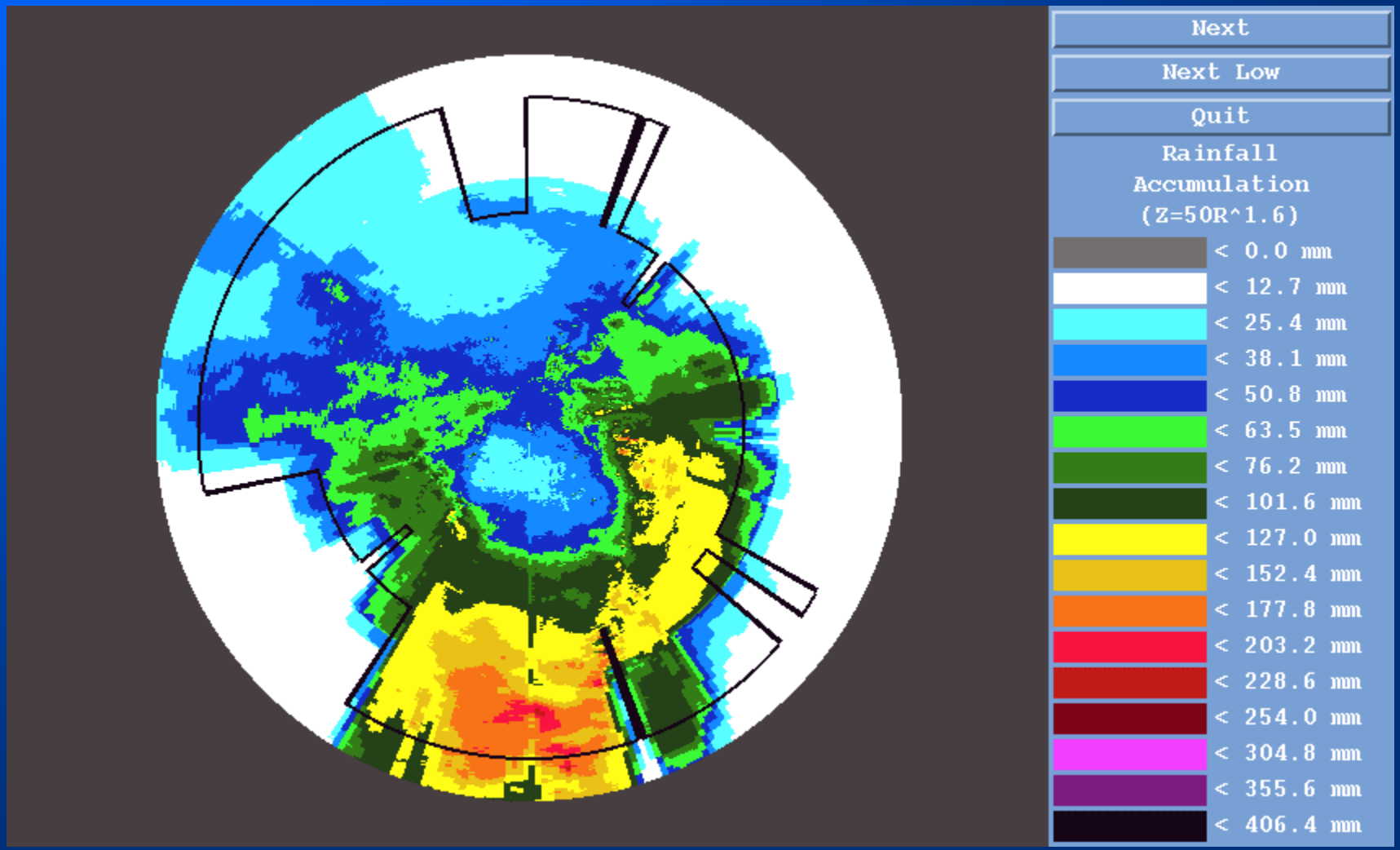
PPS - ORPG Bld 4

- Enhanced Preprocessing algorithm (EPRE) [ROC,OHD]
  - Supports new VCPs, REC, PDF, RCA
- Range Correction algorithm (RCA) [OHD]

Storm Total Rainfall - KATX, Unadjusted

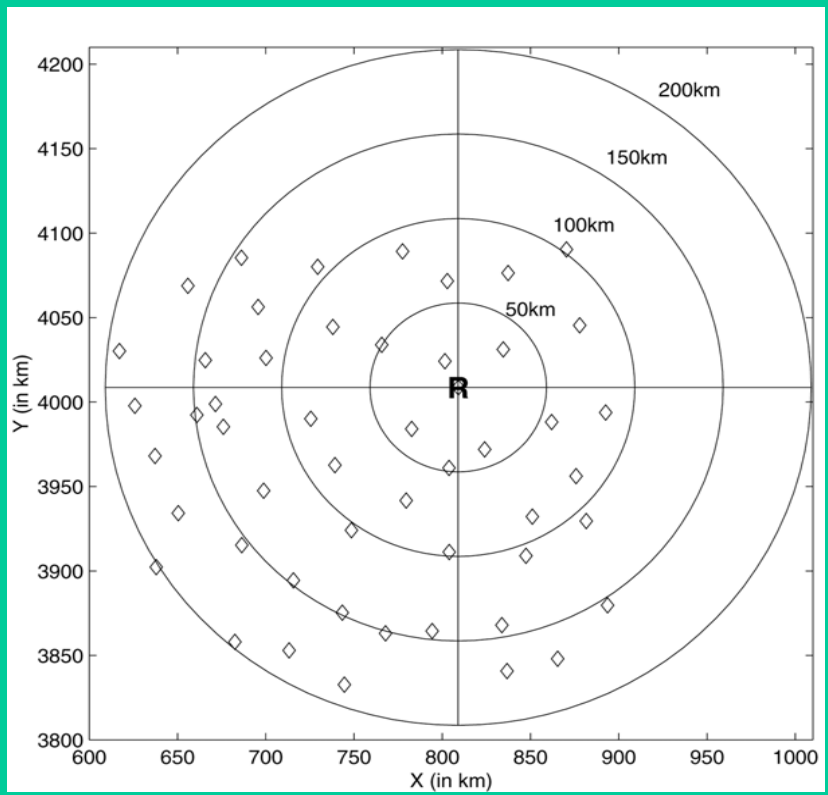


Storm Total Rainfall - KATX, Adjusted



Application to the radar data from Tulsa (OK)

- 2 years of WSR-88D data from Tulsa (Oklahoma) under an efficient format (ASCII-RLE format, Kruger and Krajewski, 1997).
- An accompanying database of rain gauge observations



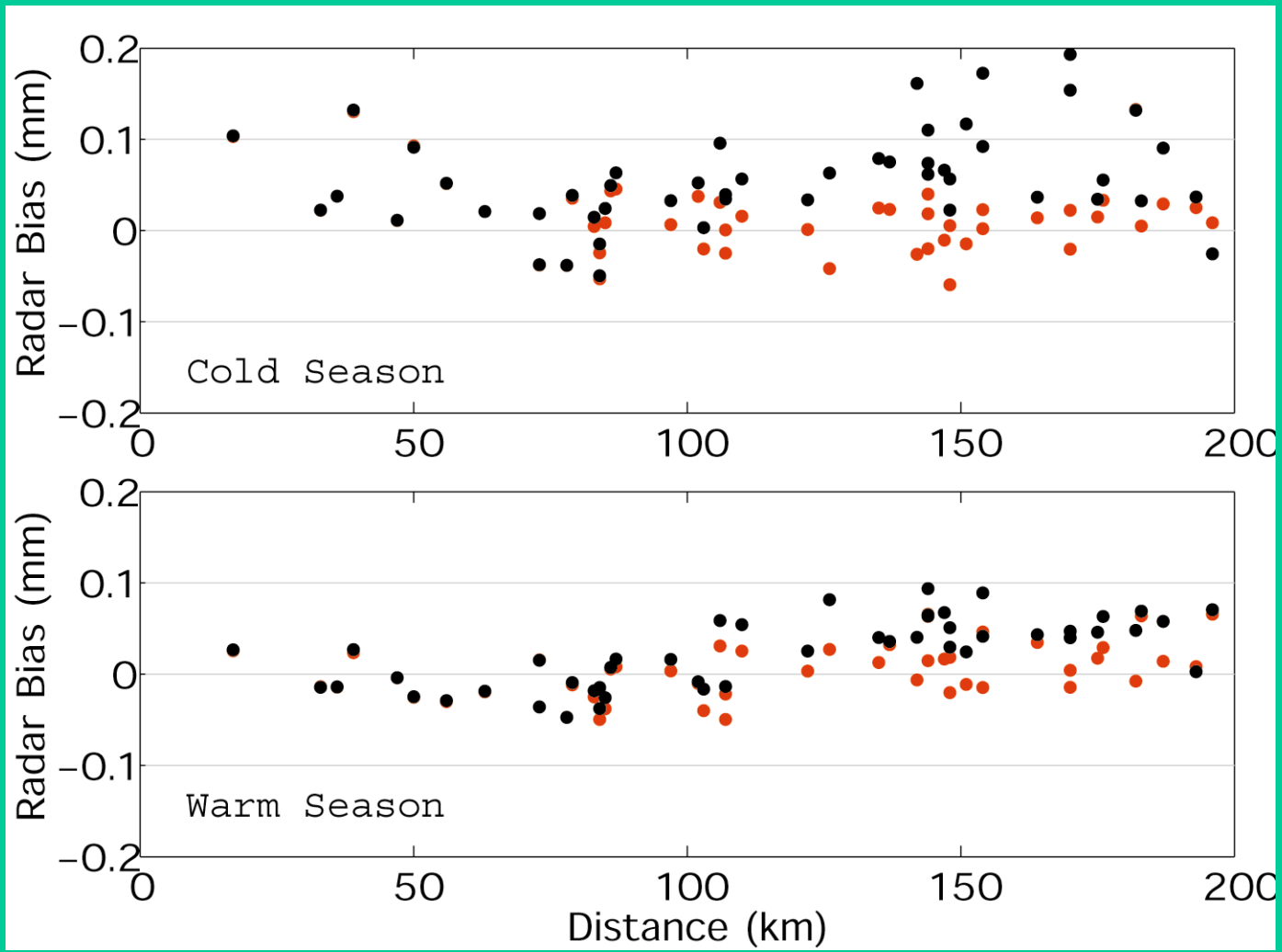
VALIDATION

- Comparison between hourly rainfall accumulation from radar and gauge

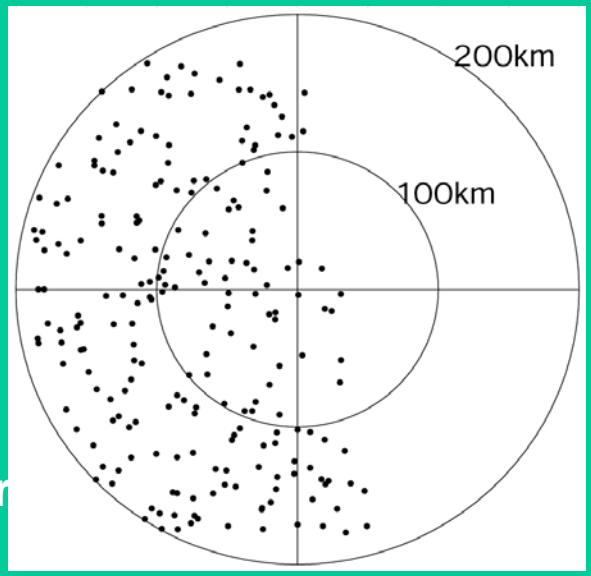
Cold Season	Without correction	Mean VPR	Tested Method	Local VPR
RMS (mm)	0.87	0.76	0.70	0.68
BIAS (mm)	0.08	0.01	0.01	0.01

Warm Season	Without correction	Mean VPR	Tested Method	Local VPR
RMS (mm)	0.70	0.72	0.71	0.65
BIAS (mm)	0.02	0.02	0.01	0.01

Range-dependant bias reduction

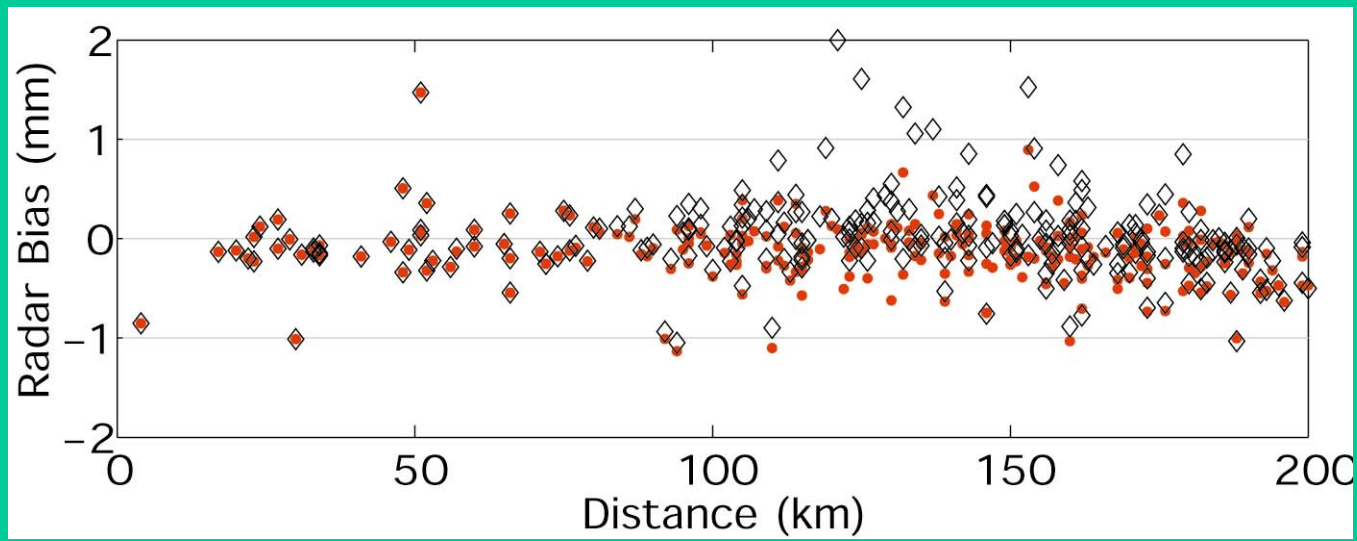


Mayville, N.D., preliminary results



- Radar data: 90 days over a 2 years period

- Rain-gauge data: Daily accumulation from the North Dakota State water commission networ



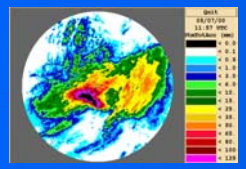
Beyond ORPG Bld 4

- Snow Accumulation Algorithm (SAA) [USBR,ROC,OST]
- Improved beam blockage delineation and correction [Iowa,OHD,ROC]
- Convective-stratiform separation [OHD]
  - Supports RCA
- Parallel precipitation processing
- Polarimetry

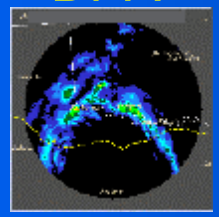
MPE - AWIPS Bld 5.1.2

- Currently runs at the NWS River Forecast Centers (RFC)
- Replaces Stage III at the RFCs
- To replace Stage II at the WFOs in Bld 5.2.2

DHR



DPA



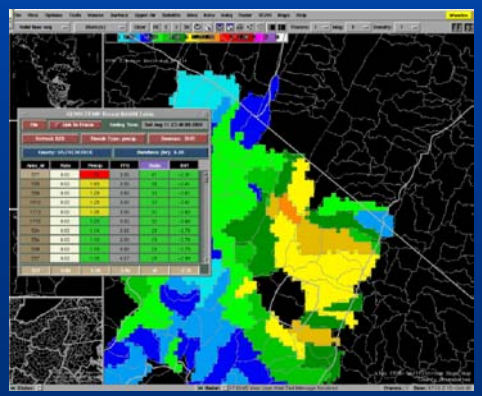
WSR-88D

ORPG/PPS

Auto-Estimator

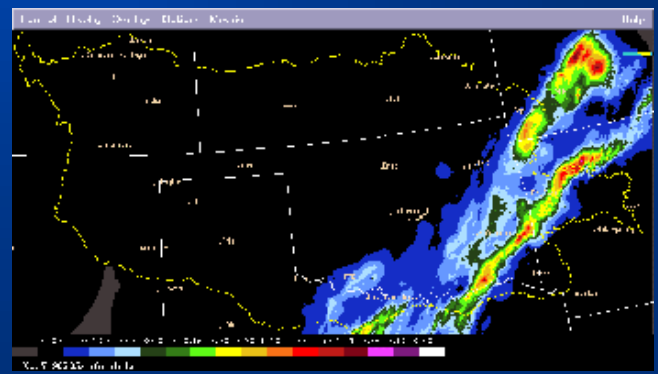
Rain Gauges

Flash Flood Monitoring and Prediction (FFMP)



WFO

Multi-Sensor Precipitation Estimator (MPE)



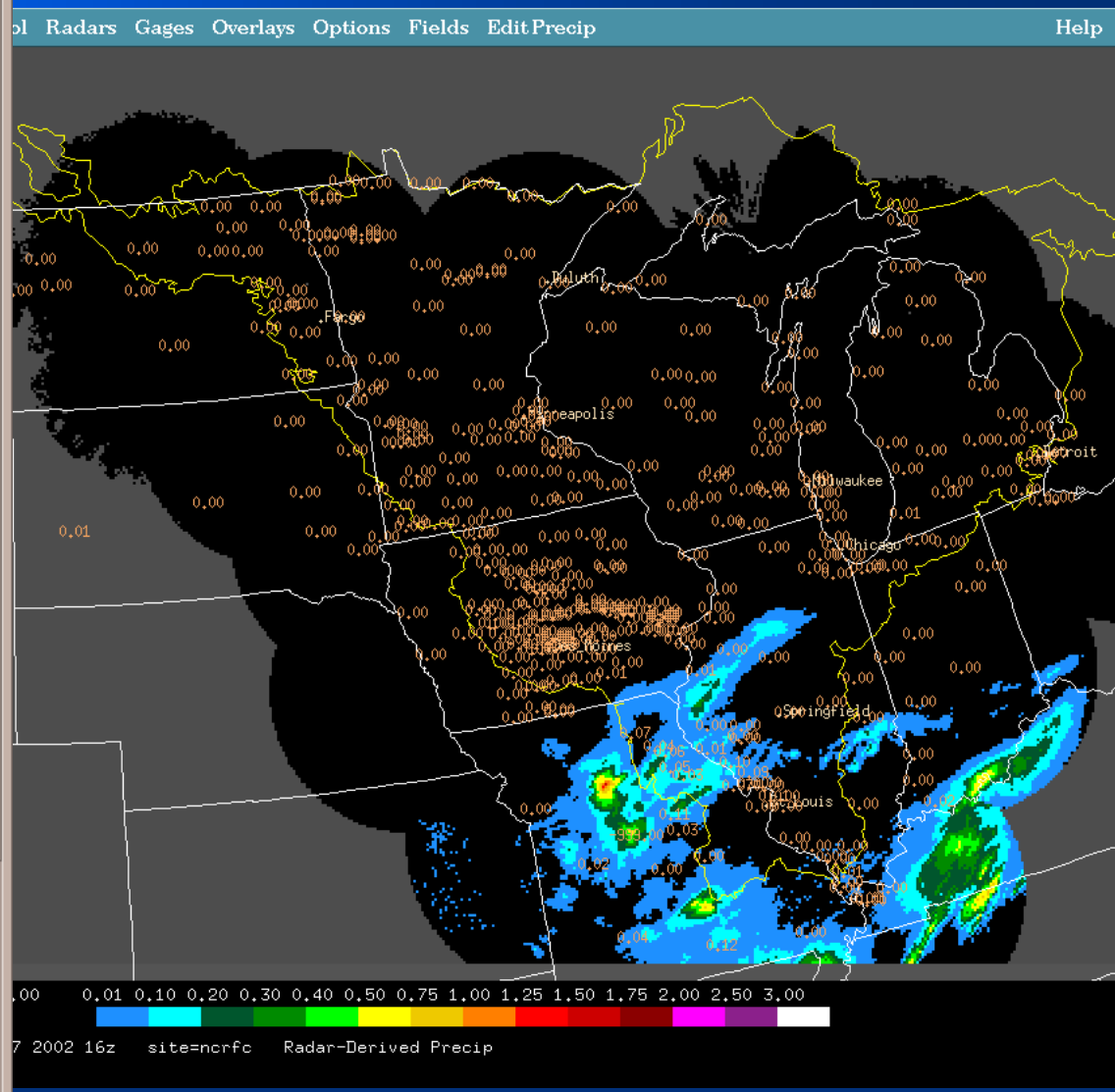
RFC

MPE MFB and Z-R List

CLOSE | APPLY | HELP | May 17 2002 16z

Radar | Bias : Manually Specified | A | B

Radar	Bias	Manually Specified	A	B
ABR	0.91	NO	300	1.40
APX	1.00	NO	300	1.40
ARX	0.72	NO	300	1.40
BIS	1.00	NO	300	1.40
CLE	0.92	NO	300	1.40
DLH	0.97	NO	200	1.60
DMX	0.74	NO	300	1.40
DTX	0.90	NO	300	1.40
DVN	1.00	NO	300	1.40
EAX	0.70	NO	300	1.40
FSD	0.75	NO	300	1.40
GGW	1.00	NO	300	1.40
GRB	0.79	NO	300	1.40
GRR	1.31	NO	N/A	N/A
ILX	0.94	NO	300	1.40
IND	1.19	NO	300	1.40
IWX	1.18	NO	300	1.40
LOT	0.95	NO	300	1.40
LSX	0.67	NO	300	1.40
MBX	1.00	NO	300	1.40

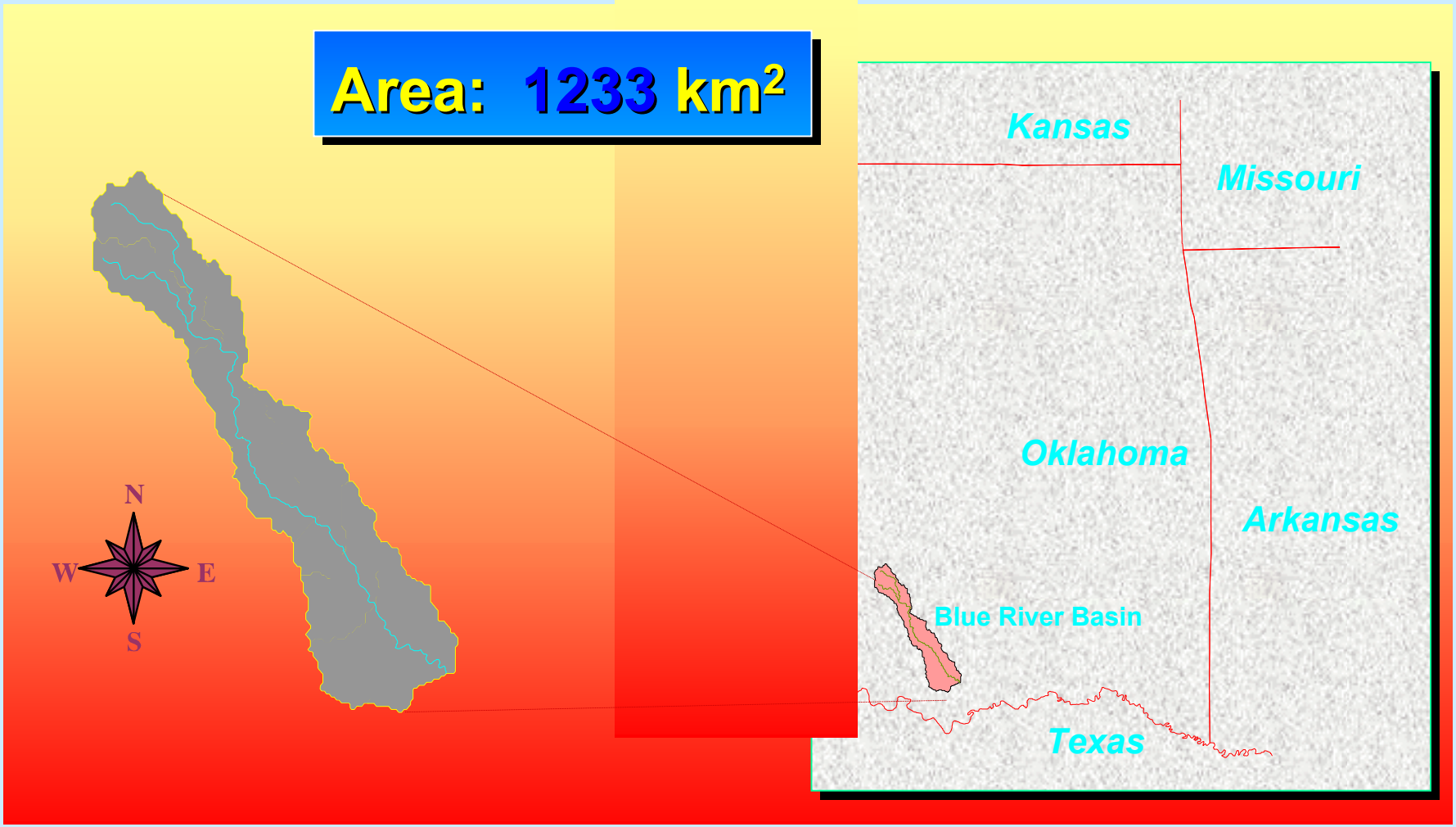


MPE - AWIPS Bld 5.2.2

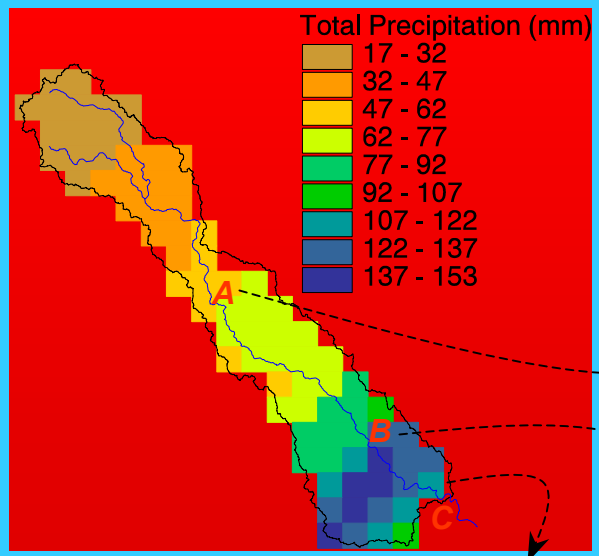
- Generation of Bias Table
- New D2D-like GUI
- Utilization of multi-hour rain gauge data
- Display of satellite-derived precipitation estimates

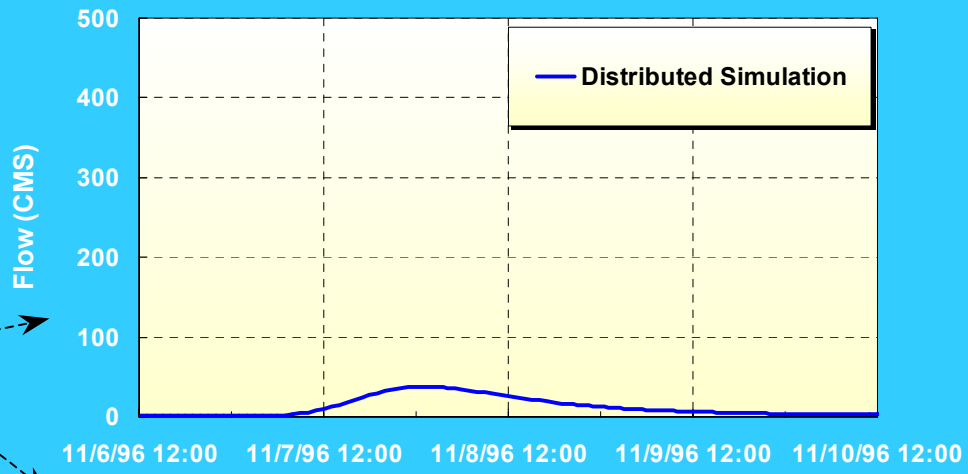
Where (radar) hydrology is headed...

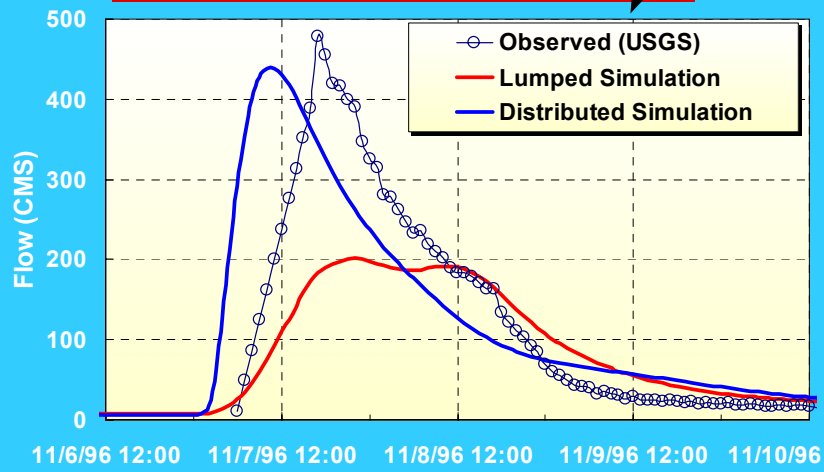
Test Basin → Blue River Basin, OK

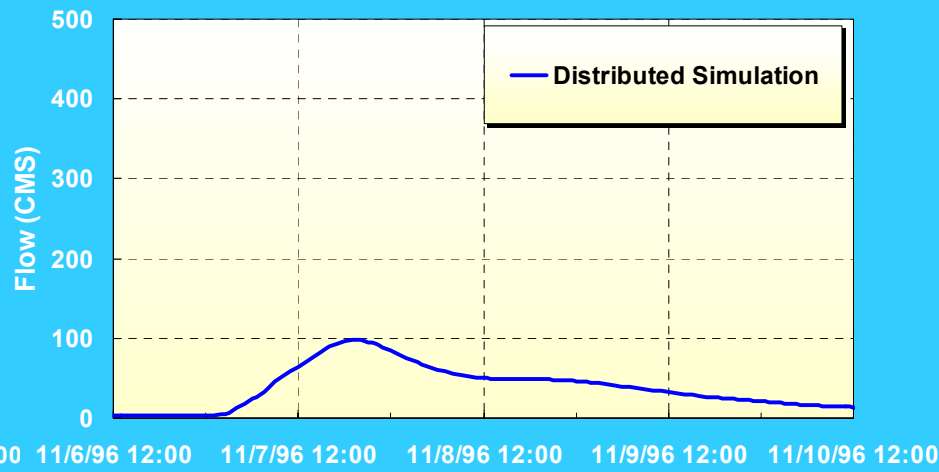


Test Results → Hydrographs @ Interior Points









In Closing…

- Radar-based/aided precipitation estimation activities are driven by the accuracy requirements that span a wide range of space-time scale (flash flood to climate)
- ORPG and CODE have (finally) opened the door for major scientific improvements
- First things first;
  - handle on systematic biases in detection and estimation (0th- and 1st-order errors)
  - provision of the quality/bias info as a part of the product

In Closing…(cont.)

- Planned and future improvements reflect where the science of hydrologic prediction is headed;
  - distributed hydrologic models (stringent accuracy requirement over a wide range of scale)
  - ensemble/probabilistic prediction (requirement for forecast uncertainty)
- Through;
  - multi-sensor
  - multi-radar
  - parallel estimation
  - rigorous quality/value assessment over a range of scales
  - provision of quality/uncertainty info as a part of the product